

REMARKS

In the Office Action, claims 1 and 26-72 are pending. Claims 1, 26-31 and 35 are rejected under 35 U.S.C. 102(b) as being anticipated by Johansson et al (U.S. Patent No. 5,447,604). This rejection is respectfully traversed.

The present invention provides a process for the production of an aqueous sol containing silica-based particles. The process makes it possible to produce silica-based sols with high stability, high specific surface area, low S-values and high solids contents as well as excellent drainage and retention characteristics. Silica-based sols with these characteristics are in demand in the papermaking industry.

For instance, examples 3-5 of the application help illustrate the invention. All of the silica-based sols in these examples show a combination of high stability, high specific surface area, low S-values and high solids contents. As stated in the present specification (see page 3, lines 24-26), the S-value indicates the degree of aggregate formation and microgel formation. A lower S-value is indicative of a higher degree of aggregation of the silica-based particles. The silica-based sols produced according to the claimed invention in example 5b showed a silica content of 20% by weight, a S-value of 37%, and specific surface areas of 700 m²/g SiO₂ and 140 m²/g aqueous sol. The remaining examples also show products having favorable properties and excellent drainage and retention characteristics.

The criticality of the process steps of the claimed invention is also shown in the examples of the present application, in which example 1 illustrates the production of standard silica sols that are used for comparison and in which no second alkalisation to a pH of at least 10.0, which is required by the claimed invention, was applied. The standard silica sols used for comparison (Sol 1a, Sol

1b, and Sol 1c) showed lower specific surface areas and/or silica contents at corresponding S-values and also lower drainage and retention characteristics.

Johansson '604 discloses silica sols and a process for their production. The process of Johansson '604 comprises: (a) acidification of an aqueous alkali water glass solution to a pH of from about 1 to about 4; and (b) alkalisation of the acid sol. The sol obtained in Johansson '604 normally will get a pH value above 10.5. See col. 2, line 29 to col. 3, line 12 and col. 5, lines 15 to 51 of Johansson '604.

Johansson '604 does not disclose first and second alkalisation steps with a step of particle growth in between, as now defined in the claims of the present invention. Accordingly, Johansson '604 does not anticipate the present claims.

Claims 1, 29-30, 32-35, 43, 47-48 and 50-53 are rejected under 35 U.S.C. 102(b) as being anticipated by Johansson et al (U.S. Patent No. 5,643,414. This rejection is also respectfully traversed.

Johansson '414 discloses a silica sol and a process for its production. The process comprises (i) acidification of aqueous alkali water glass solution to form an acid sol having a pH of from about 1 to about 4; (ii) alkalisation of the obtained acid sol to a pH of at least 8; (iii) allowing particle growth of the alkalisol to achieve a specific surface area within the range of from 750 to 1000 m²/g; and (iv) aluminium modification (see col. 2, line 40 to col. 4, line 9).

Johansson '414 discloses that the aluminium modification is carried out by means of an aluminate; sodium or potassium aluminate (see col. 3, lines 58-61). There is no suggestion of alkalising the sol in a second alkalisation step to a pH of at least 10.0 by addition of alkali, aqueous silicate solution, or a mixture thereof. Accordingly, Johansson '414 also does not anticipate the present claims.

Claims 1, 26-35, 43-53 and 61-63 are rejected under 35 U.S.C. 103(b) as being unpatentable over Johansson '414, optionally in view of Brekau et al (U.S. Patent No. 5,458,812), Vossos (U.S. Patent No. 3,714,064), Chilton (U.S. Patent No. 3,560,400) and Mindick (U.S. Patent No. 3,502,593). This rejection is also respectfully traversed.

Specifically in reference to Johansson '414, it is stated in the Office Action:

"Patentees example 1 disclosure of "about 9.5" is deemed to read on the alkalising to a pH of at least 10 claimed."

It is respectfully submitted that example 1 of Johansson '414 does not disclose or suggest the claimed pH of at least 10.0 nor, as discussed above, the claimed process in which a second alkalisation step is carried out to a pH of at least 10.0 by addition of alkali, an aqueous silicate solution, or a mixture thereof.

In particular, Johansson '414 teaches that the aluminium modification is a modification of the surface of the particles for stabilization of the surface which is carried out by means of an aluminate, such as sodium or potassium aluminate (see col. 3, lines 58-65). As the objective of the aluminate addition according to Johansson '414 is to achieve surface modification with aluminium, there is no motivation for one of ordinary skill in the art to replace the aluminate with alkali, aqueous silicate solution, or a mixture thereof.

In fact, Johansson '414 discloses no silica sol having a pH of at least 10.0, not even after addition of the aluminate which is an alkaline material. The examples of Johansson '414 disclose a pH of 9.5 after the addition of aluminate. From this it is clear that one of ordinary skill in the art would not be motivated from a reading of Johansson '414 to add alkali, aqueous silicate solution, or a mixture thereof to the sol in a second alkalisation to achieve a pH of at least 10.0, especially when such sol has already been alkalisied in a first alkalisation step and subjected to particle growth.

Further, there is also no disclosure or teaching in the cited prior art of Brekau, Vossos, Chilton and Mindnick that would motivate or suggest one of ordinary skill in the art to do so. In fact, Brekau, Vossos, Chilton and Mindnick teach different processes for obtaining different silica sols to be used for different purposes.

More specifically, Brekau discloses a continuous process for the production and concentration of silica sols. The silica particles of the sols of Brekau are non-aggregated (see col. 1, lines 3-7), i.e., they show high S-values. Furthermore, silica particles of the sols of Brekau are generally large; an average particle size of 9 to 55 nm is stated for the silica particles of reactor 3 (see col. 4, lines 27-34). The specific surface area of the silica particles of Brekau is generally low; 300 m²/g is reported in example 1 (see col. 5, lines 28-31). Brekau also does not disclose or suggest first and second alkalisation steps as claimed according to the present application. In addition, Brekau does not disclose or suggest how to produce an aqueous sol which has a specific surface area of at least 95 m²/g aqueous sol and contains silica-based particles which have a specific surface area of at least 550 m²/g SiO₂. Finally, Brekau does not relate to the production of silica sols suitable for use as drainage and retention aids in papermaking.

Vossos discloses aqueous colloidal silica sols which are concentrated, yet are in the form of extremely finely divided, discrete, dense particles and the production thereof (see col. 1, lines 15-18). Thus, Vossos does not relate to producing silica sols having low S-values and containing aggregated silica-based particles. Vossos does not disclose or suggest first and second alkalisation steps as claimed according to the present application. In addition, Vossos does not relate to the production of silica sols suitable for use as drainage and retention aids in papermaking.

Chilton discloses a process for the concentration of an aqueous silica sol (see col. 1, lines 54-55). Chilton does not disclose the use of silica sols

containing aggregated silica particles, i.e., having low S-values. Furthermore, Chilton discloses the use of large particle size silica particles having low specific surface areas (see the examples of Chilton). In addition, Chilton does not disclose or suggest first and second alkalisation steps as claimed according to the present application. Furthermore, Chilton does not disclose or suggest how to produce an aqueous sol which has a specific surface area of at least $95 \text{ m}^2/\text{g}$ aqueous sol and contains silica-based particles which have a specific surface area of at least $550 \text{ m}^2/\text{g SiO}_2$. Finally, Chilton does not relate to the production of silica sols suitable for use as drainage and retention aids in papermaking.


Mindnick discloses aqueous silica sols containing particles having an average diameter ranging from 5 to 10 millimicrons (see col. 1, lines 14-16). The silica sols of Mindnick contain discrete, dense particles (see col. 1, lines 70-72). Thus, Mindnick does not disclose silica sols containing aggregated silica particles, i.e., having low S-values. Mindnick does also not disclose or suggest first and second alkalisation steps as claimed according to the present application. Furthermore, Mindnick does not disclose or suggest how to produce an aqueous sol which has a specific surface area of at least $95 \text{ m}^2/\text{g}$ aqueous sol and contains silica-based particles that have a specific surface area of at least $550 \text{ m}^2/\text{g SiO}_2$. Finally, Mindnick does not relate to the production of silica sols suitable for use as drainage and retention aids in papermaking.

In summary, there is no disclosure or teaching in the Johansson '414 primary reference that would motivate one of ordinary skill in the art to introduce or replace the aluminate addition with a second alkalisation step to a pH of at least 10.0 by addition of alkali, aqueous silicate solution, or a mixture thereof to a silica sol that has already been alkalisied and subjected to particle growth. And, as is evident from the above, there is also no disclosure or teaching in Brekau, Vossos, Chilton or Mindnick that would alleviate the substantial deficiencies of the Johansson '414 primary reference. Absent impermissible hindsight reliance on the present disclosure, there would be no motivation for one of ordinary skill in the art to arrive at the claimed invention.

Thus, for the reasons set forth above, the present invention is both novel and non-obvious over the cited prior art and the Applicants respectfully request reconsideration of the rejection of claims 1, 26-35, 43-53, and 61-63.

Applicants note that claims 36-42, 54-60, and 66-72 are presently withdrawn with traverse. Should pending claims 1, 26-35, 43-53, and 61-63 be found in condition for allowance, Applicants hereby consent to the cancellation of the withdrawn claims.

Respectfully submitted,
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